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Verification of magnetic resonance tractography results and detection of damaged axonal paths

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Abstract

Purpose. Optimization of previously developed verification methods for the analysis of MRI data measured in healthy volunteers and patients. Analysis of axonal fiber tracking in the area of hemorrhagic stroke for better detection of damaged paths and areas in the brain. To indentify the correlation parameters with the severity of injury. Materials and methods. Axonal tractography was performed on a digital phantom with predetermined tracts trajectories and on volunteers and patients, measured on a clini-cal 1.5 T scanner with parameters specific to routine clinical measurements and on 3T ex-pert class scanner specially designed for the measurement of diffusion, which provides data with a higher spatial resolution and signal to noise ratio. Verification of the tractography results was based on proposed earlier methods of probability calculation and Shannon in-formation entropy along the paths. Results. It was found that the probability was better than the entropy in path direc-tion characterization and the entropy allowed determining the area of intersection and the branching of paths. A certain correlation was found between the degree of injury and the amount of entropy in the affected area. Conclusions. The combination of entropy and the probability of diffusion along the axonal tracts allows to estimate the probability of passage routes particular trajectory and thus can serve as a measure criterion of the reliability of the axonal tractography results. Entropy allows to evaluate the severity of the lesions, but this hypothesis needs further in-vestigation in more patients.

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Keywords

Axonal tractography, Cerebral stroke, Diffusion-weighted images, Magnetic reso-nance imaging, Magnetic resonance imaging